

Assessing the short term impacts of changing grazing regime at the landscape scale with remote sensing

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Running Title: Landscape scale changes from sheep grazing

Abstract

Livestock grazing is an important form of land use, affecting community level ecosystems worldwide. In systems that evolved with low densities of large ungulates, such as the western United States, there is ongoing debate as to the appropriate concentrations of livestock that can be supported sustainably. However, limited landscape-scale monitoring and uncertainty as to the location and numbers of grazing animals often makes it difficult to pinpoint the landscape scale impacts of livestock on ecosystems. In this study, we use remote sensing to identify landscape scale changes in Landsat TM-derived Normalized Difference Vegetation Index (NDVI), a proxy for community greenness, following changes in land use in south-central Idaho, United States. Grazing allotments in the study area have been managed by Lava Lake Land & Livestock (Lava Lake) since 2001, and recent changes include reduced grazing intensity, longer rest periods, and limited grazing in riparian zones. Additionally, sheep bands owned by Lava Lake were collared with GPS receivers to track their daily locations during the 2004-2005 summer grazing seasons. We found that increased NDVI was more likely to occur adjacent to riparian channels, which have been a focus for ecological recovery by land managers at Lava Lake. Decreased NDVI was most likely within 500 m of sheep grazing. However, the extent of impact differed depending on

land use and elevation. Decreased NDVI on allotments with a large reduction in total sheep numbers was most likely within only 60-150 m. Grazing on lands at elevations above 2300 m had no relationship to decreased NDVI. Our results suggest that grazing impacts are heterogeneous across the landscape, and depend strongly on stocking rates and elevation (which is correlated to precipitation). Spatial analysis of NDVI change can identify landscape-scale processes that may not be apparent from local monitoring. Patterns of change identified with remote sensing can guide ecosystem monitoring across extensive public and private lands.

Keywords: Conservation, GIS, land use land cover change, Landsat TM, Lava Lake Foundation, sheep grazing, spatial analysis